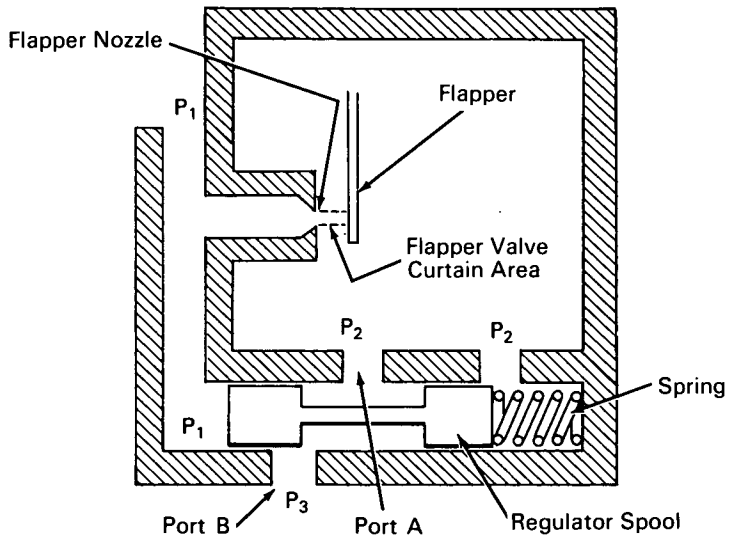
NASA TECH BRIEF

Flow Control Valve Is Independent of Pressure Drop



The problem: Remote control of fluid flow in a low-power system. Constant flow rates must be maintained despite fluctuating pressure across the valve.

The solution: A flow control valve using a flapper and nozzle flow control in conjunction with a spring-loaded, pressure drop regulator spool.

How it's done: A signal is fed to a flapper control device (not shown). This positions the flapper a predetermined distance from the flapper nozzle. The flapper valve curtain area is defined as the product of the flapper nozzle circumference times the distance between the flapper nozzle and the flapper. Flow through the flapper valve curtain area is proportional to the product of the curtain area, the pressure drop across the curtain area, and the flapper nozzle flow coefficient of discharge. The flow proceeds through port A and port B. The area of port B open to the internal pressure (P_2) of the valve is determined by the position of the regulator spool. The regulator spool is force balanced, that is, it will continue to move until pressure P_1 times the spool cross sectional area equals pressure P_2 times the spool cross sectional area plus the force of the spring. Thus, the spool will continue to move until the differential pressure force equals the spring force. With the spring force essentially constant, the differential pressure (P_1-P_2) remains essentially constant and flow through the flapper valve curtain area varies as a function of flapper position input signal. As the total pressure drop across the valve (P_1-P_3) varies, the regulator spool will move, adjusting the area of port B to maintain the pressure drop (P_1-P_2) across the flapper valve curtain area at a constant value. Flow through the valve is, therefore, proportional to the flapper position and independent of the pressure drop across the valve.

(continued overleaf)

Notes:

1. By coupling multiples of flapper valves, flow in multiple fluid systems can be maintained proportional to the same input signal.
2. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California, 91103
   Reference: B65-10121

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Thiokol Chemical Corporation
under contract to Jet Propulsion Laboratory
(JPL-WOO-039)